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UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE R-5

REPLY TO: 3420 DATE: August 8, 1986

SUBJECT: Biological Evaluation of Big Tunnel Plantation
Nevada City Ranger District (Report No. 86-13)

TO: Forest Supervisor, Tahoe National Forest

John Babin from the Nevada City Ranger District requested a biological evaluation of the Big Tunnel Plantation (T. 17 N, R. 10 & 11 E, S. 36 & 31). The area was examined on June 10, 1986 by Dave Schultz, Jerry Westfall and Keith Kohler.

Background and Observations:

The plantation covers about 500 acres and was originally planted in 1971. Most of the stock was ponderosa pine from the old seed zone II (northern west side Sierra). These trees are now 2 to 4 inches dbh and 8 to 15 feet high. The crowns are close to touching in many parts of the plantation. A minor component of sugar pine included in the original planting is largely infected with white pine blister rust (WPBR). Unstocked areas in the plantation were replanted several years ago with ponderosa pine from a local seed source. The plantation was treated for release with herbicide around 1983. This converted the vegetative competition to bitter cherry and grass, which is now quite abundant in spots.

Some of the older ponderosa pine showed extensive tip flagging from 1985 attacks by the gouty pitch midge, Cecidomyia piniinopis. Old feeding scars on the branches indicate that some trees have been repeatedly attacked. Now, it is relatively easy to identify the trees which are genetically more susceptible to attack by the gouty pitch midge.

Discussion:

The plantation is about fully stocked. While the growth rates may not express full site potential, they probably meet minimum standards or expectations. The gouty pitch midge is undoubtedly causing some growth loss, but vegetative competetion and off-site stock too are probably limiting the full realization of the site and enhancing the symptoms of gouty pitch midge attack. The 1985 attacks probably caused more branch flagging than in previous years due to the additional stress caused by dry spring weather. Normal precipitation

patterns should reduce the severity of impact caused by midge attack. The incidence of branch flagging would also be reduced if competition with brush and between trees is reduced, but branch scarring will still occur.

A much more serious and long-term risk for pest-caused damage is posed by the very nature of the plantation. Because it covers an extensive area and is comprised mostly of a single species, which is subject to stress, there is a considerable potential for mortality during its lifetime. The trees are becoming large enough to be attacked by pine engravers, Ips sp., or the western pine beetle, Dendroctonus brevicomis. Tree crowns are now closing in parts of the plantation. If left untreated, biomass and stresses will increase with time and some mortality could occur before the trees reach commercial size, particularly during a period of drought. Because there is so little diversity in the plantation, bark beetle group kills could be fairly large. This low diversity can leave the plantation vulnerable throughout the rotation. It would be advantageous to favor almost any species except ponderosa pine during thinnings.

Although white pine blister rust is present, sugar pine is still a viable part of the plantation and should be managed. Rust cankers can be placed into one of three categories: (1) non-lethal are those more than 24" from the bole; (2) lethal prunable are between 4 and 24" from the bole; and lethal non-prunable are on the bole or within 4" of the bole. (An exception to the last category is where cankers are in the upper two whorls of a tree and may be pruned out with the assumption that the tree will survive and form a new top.) These categories describe what impact the canker can have on its host and whether it can be effectively removed from the tree.

Management Alternatives:

1. **Do Nothing.** Some parts of the plantation are so densely stocked that all of the trees will not survive to a commercial size. Natural thinning is likely to involve engraver or bark beetles which will kill groups of trees leaving the rest of the stand overstocked. Because of the nature of the plantation and the stand that will develop from it, the probability of sudden losses will be much higher than in stands derived from local seed sources, from mixed species plantings, or where single age plantings are not as extensive. At worst, blister rust may eventually kill most of the sugar pine.

2. **Vegetation control.** Brush competition could be a major factor throughout the life of the stand. If the crowns are allowed to close enough to shade out the brush, inter-tree competition will increase, as will the susceptibility, of the trees to bark and engraver beetles. Reducing competition in the plantation should lower stress on the trees. This will have no effect on the susceptibility of the trees to the gouty pitch midge, but the attacks on vigorous trees usually produce only scars on the branches, rather than flagging. Allowing the plantation trees to retain as much foliage as possible should also minimize stress. Because blister rust infections tend to

occur near the ground, any treatments that increase height growth will help to shorten the period of time that a tree is susceptible to rust.

3. **Thinning.** The trees are approaching the size when they are susceptible to bark and engraver beetles. Thinning in the near future would maintain growth and increase resistance to attack by bark and engraver beetles. Discriminating against ponderosa pines which have been repeatedly attacked by the gouty pitch midge will result in general stand improvement. Retaining tree species other than ponderosa pine during thinning will increase diversity and lessen the impact of host specific pests. However, sugar pine with lethal, non- prunable cankers should be removed during thinning because they will soon die.

Even if the plantation is manipulated to the maximum extent that is reasonable, it will still basically be a monoculture of off-site ponderosa pine. In order to avoid episodes of sudden mortality in this, or similar plantations, heavier and more frequent thinning may be required to maintain growth than would be necessary in a more mixed plantation. Precautions to avoid a buildup of pine engravers in slash during any thinnings would be advantageous due to the high degree of risk.

4. **Additional Blister Rust Options.** Just because this disease is in an area does not automatically mean that all sugar pine are doomed. Many rust cankers and some bole cankers can be removed to eliminate the fungus from a tree. Other trees, even though they have lethal cankers, may survive long enough to reach merchantable size. The deciding factor is how much the infected pine will grow during the time it takes the fungus to grow down a branch, girdle the stem, and kill the tree.

Genetic resistance is the best weapon available for blister rust control, and only resistant sugar pine should be planted on sites where rust has caused damage in the past. Individual rust resistant pines may have already been identified on the District; information is available from Tree Improvement personnel at Placerville Nursery. Also, sceening sugar pine seed sources for rust resistance is now done on an operational basis at Placerville. Securing rust resistant seedlings is a lengthly process, but it cannnot be accomplished unless the first steps are taken. If you have not already begun, we strongly urge you to participate in the program to collect seed for resistance screening.

If you need additional information about these situationa, please call Dave Schultz at 415-556-4322.

Bruce H. Rolfsmeier

for RICHARD S. SMITH, JR.
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Forest Pest Management

PEST BIOLOGIES

Gouty Pitch Midge

Adults of the gouty pitch midge, Cecidomyia piniinopis, are small mosquito-like flies. Pitch midge adults emerge from late March through early May and lay eggs on elongating branch and leader tips of the primary host, ponderosa pine. The larvae that hatch from the eggs bore through the surface of the shoot and embed themselves in the vascular tissue. The larvae feed in resin-filled cavities until late winter or early spring when they crawl out of the feeding pits to pupate on the needles.

A few feeding pits on a shoot will have little effect on the tree, but as the number increases, growth and conduction will be affected. If the pits girdle the shoot, it will die. When the pits are distributed on only one side of the twig, the difference in growth rate causes a twisted branch or leader. The feeding pits cause a canker-like scar which remains visible on the twig for many years. Repeated infestations will reduce the growth rate, cause deformity and predispose the tree to attack by other organisms.

Trees under three years of age are seldom attacked. Branch and leader tips more than 16 feet high are only occasionally infested. Host tree vigor has little to do with susceptibility to the gouty pitch midge, but it will affect the impact of the infestation. The same level of infestation is more likely to produce twig and leader death in slowly growing trees than in rapidly growing ones.

The susceptibility of ponderosa pine to the gouty pitch midge is related to the type of surface of the spring shoots. During the period of active new growth, trees will exhibit one of three genetically controlled phenotypes. The shoots will either be resinous, dry and smooth, or covered with a waxy bloom. Trees with resinous shoots normally comprise about one-third of the population and are much more prone to serious pitch midge damage, although the midge is capable of developing in all three types.

Midge damage can be minimized in regeneration programs by avoiding ponderosa pine with resinous spring shoots for cone collections, seed trees or tree breeding projects. Damage will not be totally eliminated even if most of the regeneration display the less susceptible (dry and smooth or waxy) phenotypes because vegetative competition and population levels of the midge also influence the level of damage. When midge populations are very high, some trees displaying the unsusceptible phenotypes will be attacked and conversely, when midge levels are low, some susceptible trees will escape attack.

White Pine Blister Rust

White pine blister rust is caused by an obligate parasite (Cronartium ribicola) that attacks sugar and western white pines and several species of Ribes. The fungus needs two alternate hosts to survive, spending part of its life on

5-needled pines and the other on Ribes. The disease occurs throughout the range of sugar pine to the southern Sierra Nevada, but has not been reported further south. Infection of pines results in cankers on branches and main stems, branch mortality, top kill, and tree mortality.

Spores (aeciospores) produced by the fungus in the spring on pine bole or branch cankers are wind-disseminated to Ribes where they infect the leaves. Spores (urediospores) produced in orange pustules on the underside of the leaves reinfect other Ribes throughout the summer, resulting in an intensification of the rust. A telial spore stage forms on Ribes leaves in the fall. Teliospores germinate in place to produce spores (sporida) which are wind-disseminated to pines and infect current year needles. Following infection, the fungus grows from the needle into the branch and forms a canker. After 2 or 3 years, spores are produced on the cankers and are spread to Ribes to continue the cycle. Although blister rust may spread hundreds of miles from pines to Ribes, its spread from Ribes back to pines is usually limited to a few hundred feet.

Branch cankers continue to enlarge as the fungus invades additional tissues and moves toward the bole. Branch cankers within 24 inches of the bole will eventually form bole cankers. Bole cankers result in girdling and death of the tree above the canker. Cankers whose closest margins are more than 24 inches from the main bole are unlikely to reach the bole and only branch flagging will result.

Environmental conditions are critical for successful infection and limit the disease most years. Moisture and low temperatures favor infection of both hosts, and must coincide with spore dispersal for infection to occur. In California, these conditions occur only infrequently, usually in cool moist sites such as stream bottoms or around meadows. In so, called "wave years" when favorable conditions occur, high levels of infection can result. Wave years in California have occurred at approximately ten-year intervals. As one moves from sites most favorable for rust to less favorable sites, the frequency of wave years decreases.